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NEW PLASTOCERIDÆ AND A NEW CEBRIO (COLEOPTERA)

BY H. C. FALL,

Tyngsboro, Mass.

The little family of aberrant Elaterids known as the Plastoceridæ contains thus far only twenty described species from within our faunal limits, and these are very sparingly represented in the great majority of collections. The wingless females especially are very rarely taken, and in a series of one hundred of more individuals in my own cabinet only three are of this sex.

With the exception of *Euthysanius blaisdelli* Tanner, described two years ago,[1] no new species of this genus or of Aplastus has been made known in over half a century. Descriptions or five new forms in these genera, and of a new Aphricus are offered in the following pages. The types of all these are in my own collection.

Euthysanius horni n. sp.

Body above, legs and antennæ pale reddish brown, metasternum and abdomen more flavate; integuments shining, pubescence very short, pale and suberect.

Antennæ of male flabellate as usual, the terminal joint perceptibly though only slightly shorter than the branch of the 11th joint. Head densely punctate, a transverse impression between the eyes which is posteriorly angulate at middle; eyes prominent, separated on the front by a little more than twice their width as viewed from the front.

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[1] Pan Pacific Entomologist, April, 1926, p. 188.

Prothorax nearly trapezoidal, length along the median line about one-tenth greater than its width at middle; sides almost perfectly straight, only just perceptibly flaring at the hind angles, the width across the tips of the latter two-fifths greater than the apical width; surface evenly convex with only the faintest trace of the antemedian impressions so conspicuous in *lautus*; punctuation fine and not dense, the punctures separated on the average by about their own diameters.

Elytra slightly more than three times as long as wide, and one-fourth wider than the thorax across the tips of the hind angles; striæ barely visibly impressed except toward the sides and apex, the intervals nearly flat and with fine punctures which are not much larger than those of the striæ.

Propleura finely not densely punctate, becoming smoother internally; metasternum and abdomen more closely punctate. Legs slender, tibiæ straight, outer margin not sinuate.

Length 17 mm.; width 4.2 mm.

Described from a single male specimen taken at Olancha, Owens Valley, California, June 19, 1917 by G. R. Pilate.

Smaller, a little narrower, and paler in color than *lautus*, the disparity between the lengths of the terminal joint of the antennæ and of the branch of the preceding joint less marked, the prothorax more elongate with straighter sides and less divergent hind angles, much sparser punctuation, more obtuse lateral margins, and less impressed elytral striæ. Furthermore in *lautus* the propleura are densely punctate and the middle tibiæ (especially) are distinctly sinuate; not so in the present species. *Horni* agrees more nearly in size with *pretiosus* but the latter has a very much stouter thorax, the width across the tips of the strongly flaring hind angles subequal to the width of the elytra at base, and the punctuation much sparser.

I am very much inclined to believe that the species here described is that figured by Horn (Trans. American Ent. Soc. vol. IX, Pl. I, fig. 2) and alluded to by him in the accompanying text as a possible variety of *lautus*. The relatively longer terminal antennal joint and non-sinuate middle tibiæ as compared with the figure of *lautus* on the same plate are in agreement with the present species, though here the sides of the thorax are straighter and hind angles less divergent than in the figure.

Notwithstanding Horn's statement that in *lautus* the thorax is "always longer than wide at middle" it is not so in any of my dozen specimens, nor is it true of either of the two examples in the LeConte collection, in both of which the length at middle is approximately one-seventh less than the median width.

Euthysanius imparoculatus n. sp.

Smaller than the other known species of the genus; rufo-testaceous, beneath a little paler, thorax moderately shining, elytra duller. Terminal antennal joint very distinctly shorter than the branch of the preceding. Head coarsely densely punctate; eyes much less convex and less prominent than usual, separated across the front by four times their own width.

Prothorax subcampanulate, very nearly as long as the width across the middle; sides rounded in front, straight and parallel in the middle third, the hind angles strongly divergent; surface rather finely not closely punctate, the punctures separated by from one to two times their own diameters.

Elytra at base slightly wider than the distance across the base angles of the thorax; sides parallel in basal two-thirds; striæ feebly impressed, punctuation about as usual. Propleura sparsely finely punctate, polished. Tibiæ not sinuate.

Length 15.5 mm.; width 4 mm.

White Mts., Gila Co., Arizona, July 1-15, 1925 (Poling). A single male.

This is a very distinct species, separable at once from all others known by its coarsely punctate head and non-prominent eyes. In the present species and also in *lautus* the scutellum is minutely notched at tip; there is scarcely a trace of this notch in either *pretiosus* or *horni*.

Aplastus scabripennis n. sp.

Elongate, parallel, brown, head and elytra dull, thorax shining, pubescence grayish moderately conspicuous.

Head densely rather coarsely punctate, antennæ long, strongly serrate, the 8th joint attaining the tip of the hind angle of the thorax; joints 2-3 small, subequal, together two-thirds as long as the 4th.

Prothorax slightly wider at middle than its median length, sides straight and moderately diverging to the hind angles which are more strongly divergent and carinate; disk convex, median line feebly impressed, punctuation somewhat finer than on the head, rather sparse at middle, the punctures there separated by from one to two times their diameters, closer toward the margins. The sides are evidently though feebly margined.

Elytra nearly parallel sided, three times as long as wide, very feebly obsoletely striate, intervals densely scabrous punctate.

Last ventral segment one-half longer than the preceding, feebly sinuate each side of the apex which is narrowly subtruncate. Middle and hind tarsi distinctly longer than the tibiæ.

Length 16 mm.; width 3.9 mm.

California (Camp Nelson, Tulare Co., Aug. 28, 1913); a single male example.

By Horn's table this species is to be associated with *optatus*, from which it differs by the almost obsolete elytral striæ and the densely scabrous punctate and dull interspaces. In *optatus* the 3rd antennal joint though small is plainly longer and wider than the 4th; only very slightly so in the present species.

Aplastus piceicollis n. sp.

Form slender, head and pronotum piceous, elytra ferruginous brown, strongly shining throughout, the pubescence sparse and very fine.

Head closely strongly punctate; antennæ strongly serrate, 8th joint reaching tip of hind angle of thorax, 2nd joint very small, transverse, 3rd subtriangular, very nearly twice as long as the 2nd and distinctly longer than wide, the two together about two-thirds the length of the 4th joint.

Prothorax about one-seventh longer on the median line than the median width; sides straight, barely visibly diverging to the flaring hind angles which are strongly produced and finely carinate; front margin briefly sinuato-truncate at middle, thence straight and oblique to the front angles; disk finely sparsely punctate, median line obsoletely impressed; sides finely margined.

Elytra three and one-half times as long as wide, very slightly attenuate posteriorly, finely striate, intervals finely not densely punctate and shining.

Prosternum longitudinally obtusely carinate in posterior half. Last ventral segment barely visibly sinuate each side of a narrow apical truncation; legs slender, tarsi slightly longer than the tibiæ.

Length 15.5 mm.; width 3.5 mm.

California (Monache Meadows, Tulare Co., 8000-8300 ft., July 15-18, 1913); a single male collected by G. R. Pilate.

Allied to *optatus* by the margined sides of the prothorax but more slender, with longer 3rd antennal joint, and with the prothorax distinctly longer than wide. The dark color of the head and thorax may or may not prove constant and the same may be said of the prosternal carination.

Aplastus productus n. sp.

Moderately elongate, distinctly attenuate posteriorly, brownish ferruginous, moderately shining, finely pubescent.

Head closely rather coarsely punctate; antennæ moderately strongly serrate, 8th joint reaching the hind angle of the thorax, 2nd and 3rd joints very nearly equal, each wider than long, together about two-thirds as long as the 4th.

Prothorax about nine-tenths as long on the median line as the median width, sides nearly straight and moderately divergent, the hind angles relatively short and only slightly more diverging than the sides; punctuation fine, nearly evenly dispersed, the punctures separated by about twice their diameters as a rule; disk rather strongly evenly convex, sides finely margined.

Elytra not quite three times as long as wide, distinctly attenuate from the humeri, sides nearly straight as far as the apical fourth, striæ fine but distinctly impressed, intervals moderately punctate.

Prosternum not at all carinate; last ventral deeply sinuate each side of the apex which is produced to form a subtrapezoidal lobe nearly as long as wide and having its apex distinctly emarginate; middle and hind tarsi noticeably longer than the tibiæ.

Length 14.5 mm.; width 3.8 mm.

California. A single male from Fresno Co.

This species like the two preceding falls near *optatus* by Horn's table, but it differs conspicuously from all of these by the short hind angles of the thorax and the remarkable apical ventral process.

Aphricus tenuis n. sp.

Very elongate, parallel, dark fuscous brown, moderately shining, pubescence fine, short, grayish and not dense.

Antennæ long, filiform, attaining the apical third of the elytra, joints 2-3 small, the latter slightly longer, together about two-thirds as long as the 4th; 4-11 very gradually increasing in length and diminishing in width, nearly parallel sided, the 4th about two and one-half times as long as wide, the 11th about seven times as long as wide and two-thirds longer than the 4th. Front feebly concave, margin acute, narrow and only slightly reflexed, oblique at sides, subtruncate at middle, rather finely and not closely punctate; eyes moderate.

Prothorax scarcely wider than the head, one-fourth longer than wide, sides straight and parallel almost throughout, a little incurved at apex and with moderately divergent hind angles which are very finely feebly carinate; side margins fine and entire, gradually obliquely descending toward the front; surface very finely sparsely evenly punctate, integuments polished.

Elytra elongate, parallel, a little more than three times as long as wide, three and one-third times as long and not quite one-fourth wider than the thorax; punctate striate, the striæ scarcely impressed except slightly so at base, intervals sparsely finely punctate.

Prosternum and propleura finely sparsely punctate, metasternum and ventral segments more closely punctured, the terminal segment especially more densely so. The terminal segment is obliquely subsinuately narrowed through the greater part of its length, paler in color at apex which is narrowly subtruncate and clothed with more yellowish pubescence; it has a submarginal impression each side near the base.

Length 6-8.2 mm.; width 1.4-1.75 mm.

Described from a series of seven specimens taken in the Pinal Mts., Arizona, 5000 ft. (O. C. Poling collector).

There are no obvious secondary sexual characters in the series at hand, but one example, from the exposed genitalia is certainly a male, and it is highly probable that all are of this sex.

I am by no means entirely satisfied as to the propriety of referring this species to Aphricus, from the type (*A. californicus*) of which it differs in the following respects. Tarsal joints 1-4 decrease rapidly in length, the basal joint subequal to 2 and 3 united and joint 2 subequal to 3 and 4 united; in Aphricus joints 1 and 2 are subequal while 3 and 4 are only slightly shorter. In the present species the side margins of the thorax are distinct and entire, in Aphricus they are in great part obliterated. In the present species the middle coxæ are very narrowly separated and the metasternal process between them is very acute; in typical Aphricus the middle coxæ are more widely separated, the metasternal process wider and obtuse at tip. In this connection it should be remarked that the side margins of the prothorax may be either present or absent in Aplastus and that while *Aphricus luteipennis* agrees with *californicus* in tarsal structure and non-margined thorax, it has the more approximate middle coxæ and acute metasternal process of the present species. The mandibles in the present species are acute at tip nearly as in *californicus*, but with the tooth of the inner margin less remote from the tip. The prosternal lobe is extremely short and obtusely rounded, the prosternal sutures nearly straight, single, and not excavate in front, the coxal plates scarcely toothed at the insertion of the thighs, and the sixth ventral segment not visible, all as in *A. californicus*.

Cebrio speratus n. sp.

Moderately elongate, parallel, dark brown and somewhat shining above; antennæ, legs and body beneath rufo—to fulvo-testaceous. Head densely strongly punctate, labrum broadly angulate emarginate. Antennæ moderately serriform, passing the hind angles of the thorax by about four joints, 3rd joint slightly more than half as long as the 4th, median joints scarcely one-half longer than wide.

Prothorax at middle about one-fifth wider than the median length, sides feebly arcuate to nearly straight, converging slightly toward the front, lightly sinuate before the hind angles which are small and strongly divergent; surface rather finely punctate, the punctures distant on the average by their own diameters or a little more.

Elytra nearly parallel sided, four and one-half times as long and one-third wider than the thorax; striæ rather feebly impressed, the strial punctures not or with difficulty distinguishable from those of the closely punctate intervals.

Prosternal intercoxal process narrow or sublinear, last ventral segment evenly rounded at apex.

Length 12.5 to 14.5 mm.; width 3.6 to 4.2 mm.

Described from a series of twelve specimens from Hope, Arkansas (June 18—July, Miss Louis Knobel) and Winnfield, Louisiana (June 15, G. R. Pilate). The type is from the first named locality; all examples are males.

This species is allied to both *bicolor* and *antennatus*. From the former it differs in being generally smaller, with more finely and less closely punctured thorax, more feebly impressed elytral striæ, narrower prosternal process and unemarginate last ventral. Concerning a specimen sent to Mr. Schaeffer for comparison with his type of *antennatus*, he writes—"Differs from *antennatus* in being less elongate, the punctuation of the thorax finer and less close, the hind angles more strongly divaricate, the antennæ shorter with the joints less strongly produced apically."

MODIFICATION OF THE NEST-BUILDING HABITS OF POLISTES.

By Phil Rau,

Kirkwood, Mo.

The shape of the nests of *Polistes* is not determined by the iron-clad instincts of the builders. Under pressure of emergency, *Polistes* builds cell upon cell, regardless of the shape of the nest as a whole. One often finds elongated nests of *P. pallipes* (fig. 1.) that have been built in the space between two boards in a shed. The builder is obliged, if she is to use the chosen location, either to limit the size of her nest or modify it; she has proven herself capable of adapting her handiwork to new requirements.

Figures 2 and 3 show two nests of the same species, *P. pallipes*, that were built in the narrow space behind closed shutters; one was on an old building at Creve Coeur Lake, Mo. and the other at Clifton Terrace, Ill. In the nest in figure 2 where horizontal expansion was impossible, the wasps built a sky-scraper, piling tier upon tier of cells, all of these slanting upward toward the horizontal, whereas the normal cells fall vertically. The nest, illustrated in fig. 3, likewise adapted to narrow space, shows the same tendency in construction, but in this case some of the cells slant sufficiently toward the vertical to show that the workers were trying to give the larvæ homes which nearly approached the normal position. A third such nest had a dozen large cells built horizontally in a haphazard way on top.

Not only in *P. pallipes* do we see such digressions, but in *P. annularis* also. I have examined two large nests of *P. annularis*, where I found from three to five cells that were being fashioned about the roof at the base of the petiole. These, however, were not large, and in all probability merely showed the building instinct misdirected, *i. e.* the workers were probably adding paper pulp to strengthen the petiole and so far forgot themselves as to fashion cells at the wrong place. "Gross ist die Macht der Gewohnheit." Certainly *P. annularis*, in extending her nest, does not need to build skyward, for her nests are in the trees, where she has ample space wherein to expand normally.

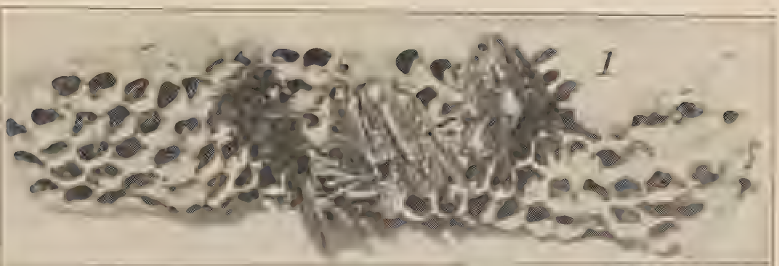
The *P. rubiginosis* nests were usually built in the dark space between the weatherboarding and the inside wall of an old house. One was also placed in a narrow space between two upright timbers, and as the nest grew to fill the entire space it took on the peculiar oblong shape. But the space was apparently not sufficient, for on the back of the nest a row of 10 cells (arrows in fig. 4) was begun. The shape of the normal nest is probably round with the petiole in the center. In this case, the petiole had not sufficient strength to hold the mass, and as the season neared its close, the nest fell and lodged on a joist below.

Thus, to the credit of at least some species of *Polistes*, let it be said that wasps do not yield to defeat when the nest has outgrown its quarters, but they make the best of the situation and continue building. Let it be said, too, to the discredit of some members of these species, that they have not the foresight to choose sites large enough to accomodate the growing family, but that too late they discover their cramped quarters.

These nests reveal the formation of a habit which may some day be developed with some degree of permanency. They show that the wasps have discovered, or stumbled upon, the fact that both sides of the wall or roof can, in emergency, be used to support cells. Alas! it is too much to hope that we may in our brief lifetime see the crystallization of a disgression, adaptation or new economy like this into a regular habit. That type of nest, *i. e.*, with cells attached to both sides of the main supporting-platform, thus making them open in opposite directions, is made by *Belonogaster junceus* of the tropics.

One small nest of a *P. pallipes* queen which differed from the normal in its method of attachment to its support was observed. It was only a quarter-inch below the roof of a railway shed, yet it was attached to a vertical timber; hence the petiole, which is usually vertical and straight, made a horizontal beginning and turned sharply downward elbow-wise. It is obvious that a nest could never attain any considerable size in that position.

Vespa builds combs in tiers and *Polistes* builds but a single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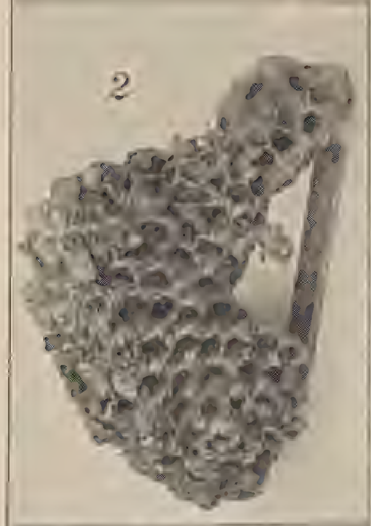
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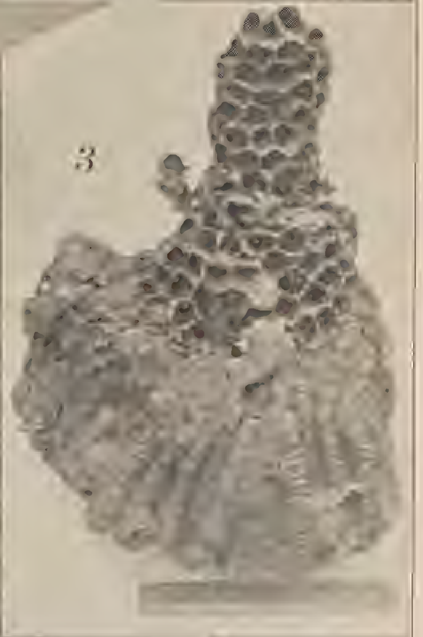
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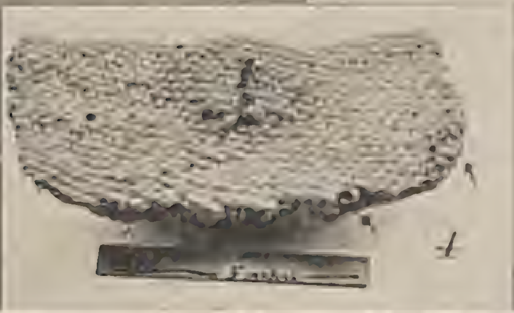
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RAU—POLISTES

comb. One nest of *P. rubiginosis* was built a second year in the same site as the first, in the narrow space between two boards in an old refrigerator car. The result was that the second comb was attached to and below the first, giving the nest the appearance of the combs of *Vespa*. This was merely an accident due to the narrowness of the space, combined with the persistence of the *rubiginosus* queens in returning to their old home in the spring. But it is just by such accidents that new habits get a foot-hold. In another place, I found a nest in the narrow space between the inner and outer walls of a barn. Here one tier of cells was built below the other, much after the manner of comb-building in tiers by the Vespine wasps. This may point to the rise and evolution of the habit of arranging combs in tiers. Who knows but that *Vespa* at one time may have built single combs as do *Polistes* to-day, and who knows further but that a similar accident of crowding may have caused her to build tier below tier until to-day we have this practice fixed in the habits of the *Vespa*?

EXPLANATION OF PLATE IV.

Fig. 1. *Polistes annularis* seeking shelter from the cold in an old nest of *Polistes pallipes*

Fig. 2. Nest of *Polistes pallipes* built in a tight corner.

Fig. 3. A sky-scraper nest of *Pollistes pallipes*.

Fig. 4. Nest of *Polistes rubiginosus*.

THE RECONSTRUCTION OF DESTROYED NESTS BY POLISTES WASPS.

By Phil Rau,

Kirkwood, Mo.

Eight nests of *P. pallipes* and one of *P. variatus* were removed from the wall of a shed on July 21. The adult wasps were driven away when the nests were knocked down, but soon all of them settled again upon the old location of their homes. After only three days I found that each group had reconstructed its nest on the identical spot where the first one had been removed. Each of these nests already contained from 14 to 22 cells, and almost every cell contained an egg. Here, in case of hasty construction to replace a lost population, we see the economy in the method of building many shallow cells at first instead of few very deep cells. In the one nest of *variatus*, having seven adults, there were 22 cells. This shows that complete families, when disturbed, quickly rebuild, but notes elsewhere show that queens seldom do.

On June 15 and 16, when only queens were on the nests, all the station sheds along the railroad tracks were repainted; in the process, six new *P. pallipes* nests were knocked down at the station of Wickes, but not one was rebuilt that summer.

At Cliff Gave, on June 29th, I found a queen mother working on a newly begun nest with only six shallow cells. This tiny nest was unusual at this time of year, when all the other nests already had workers; but it showed at least that one queen did not lose courage in a calamity, but had the impulse to build anew.

A *P. pallipes* nest was knocked down from the ceiling of an open pavilion at Meramec Highlands in the latter part of July; on August 6 the wasps were busily rebuilding. I got the nest, and found it to be composed of shallow cells of less than one-third normal depth, 30 in all, and all but one containing an egg. Twenty of the cells contained also from one to three drops of various sizes of the transparent, jelly-like material described elsewhere. It is interesting to note that they made 30 cells one-third size instead of 10 full-sized cells, thereby giving the eggs the advantage of much-needed time at this late season, while the paper in all could be added from time to time as it was needed. This method is commonly followed by queens also.

On August 8, I took a nest and left four workers behind. The nest was rebuilt in the identical spot, and during the eight days following, twelve shallow cells were constructed; at the end of that time, each had an egg, and in the angle opposite the egg was a drop or two of clear honey. This seems an excellent accomplishment for four individuals in eight days.

One of these colonies of *P. pallipes* even made a third nest, when the second was taken down for study, but not on the identical spot; the third nest was placed two feet distant from the old site.

TROPHALLAXIS IN *POLISTES PALLIPES.*

By Phil Rau

Kirkwood, Mo.

Wheeler,[1] in his paper on the origin of social habits, has given us some very interesting data on the mutualistic relationship between the mother or adult workers of insects and their larval brood. His data show that the relationship is clearly cooperative for ants, and he gathers from various sources similar data for other insects, and coins the word *trophallaxis* to encompass this phenomenon.

In the orphan nests of *Polistes pallipes* we have often seen behavior substantiating Dr. Wheeler's data, in a species where this type of behavior has not yet been recorded. The details more than substantiate the observations on other insects, because the behavior we record can be only purely instinctive, since the observations were made on orphan colonies, with the queen and older workers gone before these individuals had come to light, and hence there was no possibility for the habits to be learned from others.

On two occasions, I noticed that the foster-queen, just after feeding the larvæ, would stand on the nest and make a prolonged grating noise by rapidly vibrating her body, wings and legs. The noise was one which I had never before heard, and which is probably a signal to the larva, for immediately after this performance she would poke her head into each of the cells. I suspect that by this process she obtained a drink of saliva, but I have no proof of this except that her mouth parts were protruding and in motion when she withdrew her head. I suspected that she was going in for this purpose, and put my eye close enough to see when she came out of one cell; a large, glistening drop of liquid was in her mouth, which she soon swallowed. My next move was to see if this liquid was used by the adult for food, or if it was collected, a drop at a time, and placed with the eggs in other new cells. Wheeler says that the females feed the young in exchange for the saliva which they emit at the time of feeding, but here we saw the saliva emitted long after they had been fed. I wonder if a worker can get a drink whenever it taps the head of a larva just as I can cause a large drop to come by teasing it with the head of a pin.

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[1] Wheeler, W. M. A study of some ant larvæ, with a consideration of the origin and meaning of the social habit among insects. Proc. Am. Phil. Soc. **57**: 293-343. 1918.

On one occasion two foster queens, after feeding the larvæ, went into the cells after sounding a noisy warning, evidently for the purpose of obtaining saliva. I watched very closely, and this time was able to see the method. The queen (so she will henceforth be called) stood on a nest with her head at the opening of a cell and her antennæ inside, probably touching the larva. Her head was then rapidly rammed or beaten against the wall of the cell; the whole body was in motion, seeming to actuate the head, and this rapid vibration of the head against the paper wall caused the strange sound. In one cell this drumming was repeated six times, and the duration of each round of it was one-fourth to one-half minute. After each trial the queen thrust her head into the cell, but obtained no saliva. I too could peer in by coming close beneath the nest, and there I found that after each serenade by the queen, the mouthparts of the larva were in agitated motion as if making effort, and a very small, glistening drop appeared on the mouth. In all probability the amount was not sufficient to satisfy the demands of the queen, for only after the sixth trial did she thrust her head far in and keep it there. These noises must have stimulated some others near by, for they too responded with a glistening drop in the mouth; into one of these cells she entered without the preliminary music. In most of the others, however, the warning was given but once. The queen's antennæ probably also acted as a stimulus, but her body always obstructed my view at that moment so I could not clearly see this. This first foster-queen had no exclusive patent rights on this scheme, for the second one used precisely the same methods.

This fact that the honey-dew, coming from the mouths of the larvæ, is lapped up and relished by the workers, is not new, but has been recorded for other species of *Polistes* and other insects. Janet was able to prove in 1903 that the secretion is a product of the salivary or the spinning glands, and that it flows from an opening at the base of the labium. This act as I have observed it in orphan colonies must have been purely instinctive, since the individuals certainly had never been taught this trick, and the larvæ responded readily to the noisy tapping. They freely gave up this honey-dew also without associating this action with the noisy vibrations, for teasing the mouth-parts with a pin-head caused the same response. It is quite likely that, as Wheeler has so ably shown, this behavior is the cause of the beginning of the social habit. There is, however, another phase to the condition of trophallaxis, in the hypothesis that it might be absolutely necessary for the larva to rid itself of the substance that the workers so willingly take. In larvæ of this and various other species, there is no provision made for ridding the body of excretory products. During the period of feeding, the larvæ, being confined in close quarters, have no place for refuse. In most of the *Trypoxylon* wasps and in mud-daubing wasps, *Sceliphron cæmentarium*, this excretory material is passed from the body in one mass, just before pupation; it is spread and moulded to form a shell or cocoon covering the body. In *Polistes* cells, after the adults have emerged, there always remains up against the roof of the cell, a hard reddish mass of chalky material which is the sum total of the excretory products accumulated during the life of the larva. The thought comes to me, if the solid excretory matter leaves the body in that form what becomes of the liquid excreta? In the plant-lice, we know that the honey-dew, so much relished by the ants, is waste matter; why should that emitted by *P. pallipes* larvæ not likewise be excretory material? The only difference at once apparent is that one insect is relieved by delivery of this liquid from the posterior end, and the other by way of the anterior aperture of the body—a small digression when one considers how Nature disregards the method to gain her ends economically.

The question still remains, probably never to be solved, whether the *Polistes* nurse feeds the larvæ in order to get the honey-dew, or whether she relieves the larvæ of their moisture to save their lives and has in time acquired a taste for it, but one can feel amply sure that the larva does not give this honey-dew because it loves the nurse or because it purposes to wheedle its keeper for a good meal. The larva at the slightest stimulus gives up its drop, perhaps only because it wants to rid itself of so much irritating material.

A NEW SPECIES OF CONICEROMYIA FROM CUBA (DIPTERA; PHORIDÆ.)[1]

By Charles T. Brues.

In 1923 Borgemeier described from South America a remarkable genus of Phoridæ to which he gave the name of Coniceromyia. It is characterized by the extremely elongated, pointed antennæ of the male which bear an apical arista. The male also has the front tibiæ remarkably modified in the type species, with a large bristle near the base followed by a deep emargination of the tibia. Later ('24) he added two other species, one of which has the front tarsi much flattened in the male, with a long, finger-like process extending from the edge of the basal joint. Furthermore, the costal vein is strongly thickened in both sexes.

Recently while in Cuba at the Harvard Biological Laboratory, I had an opportunity to visit the San Juan Mountains, which lie to the southeast of Soledad where the laboratory is located. In the material collected there I find a species of Coniceromyia, represented by both sexes, quite different from any of the South American forms.

It may be distinguished as follows:

Key to the Species of Coniceromyia.

1. Anterior tibia with a series of three large stout bristles on the basal half; front tarsi of male greatly widened, the first joint with a long slender projection from its edge near apex (Fig. 1, *b*). . . . . *C. cubensis* sp. nov.
Anterior tibia with only one large bristle, placed before the middle, or with two in this position... . . . . 2.
2. Thorax dark fuscous in color, anterior tibia with a series of two bristles before the middle. . . . . *C. fusca* Borgm.
Thorax yellowish or ferruginous, anterior tibia with a single large bristle before the middle, sometimes with a much smaller one immediately next to it . . .. 3.

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[1] Contribution from the Entomological Laboratory of the Bussey Institution, Harvard University, no. 300

3. Dorsal face of anterior tibia of the male with a series of seven small bristles forming a series between the large bristle and the apex; first tarsal joint with a long slender projection from its edge. . . . . *C. anacleti* Borgm.
Dorsal surface of anterior tibia of male without a series of bristles in this position. . . . . *C. epicantha* Borgm.

Coniceromyia cubensis sp. nov.

♂Length 2.0 mm. Black, including the antennæ; four posterior femora piceous; front legs and all tibiæ and tarsi yellowish brown; halteres white; palpi yellow. Wings hyaline, with a brownish tinge, stronger toward the costa, the costa at extreme base and most of the first vein yellow. Front shining, one-fourth broader than high; with a fine, clearly impressed median line; ocelli on a raised triangle. Bristles large and strong; two post-antennals very close together, reclinate and slightly divergent, about half as large as the other bristles; lower frontal series of four equidistant, their bases forming a line which curves gently downwards medially; upper frontal row forming a similarly curved series, the median pair a little closer to one another than to the lateral bristle; they are placed high on the front, so that the median pair form an equilateral triangle with the anterior ocellus; ocellar row of four. Eyes distinctly pubescent; postocular cilia strong. Cheek with three, large, downwardly

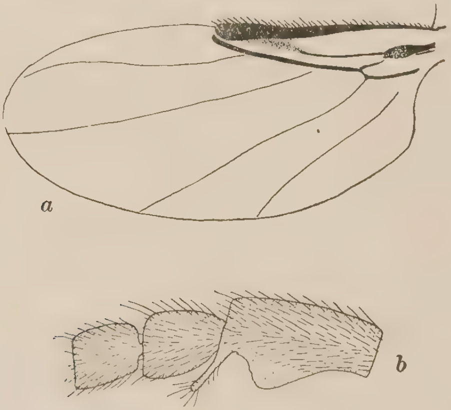

Fig. 1. *Coniceromyia cubensis* sp. nov. *a*, wing; *b*, base of front tarsus.

directed macrochætæ; palpi with moderately short bristles. Third antennal joint pyriform, pointed at tip, three-fourths as long as the eye; arista terminal, as long as the antenna. Mesonotum shining, with one pair of dorsocentral macrochætæ. Scutellum nearly half as long as wide, with four marginal bristles; one bristle above and several below the prothoracic spiracle. Mesopleura entirely bare. Front tibiæ simple, not notched, nor emarginate, with a series of three large bristles, one at the basal fifth, another at the second fifth and the third just beyond the middle; all tarsal joints widened, the first with a triangular extension along the inner edge and a slender, projecting process at the tip (Fig. 1, *b*) as in *C. anacleti* Borgm. Middle tibia with a pair of very large bristles near the basal fourth on the posterior surface and another, not quite so large externally before the tip. Hind tibia with one large bristle just before the middle behind, one externally at apical fourth and three terminal spurs. Abdomen large, dull above, with none of the segments lengthened. Costa half as long as the wing, (Fig. 1, *a*) its bristles very short and closely placed, very slender at base gradually thickened beyond and very broad at apex; first vein thickened just before tip; third vein stout, of even thickness; fourth vein unusually close to the costal margin, slightly curved at base; fifth, sixth and seventh veins nearly straight.

Female. Length 1.3 mm. Similar to the male, except that the antennæ are small, oval, with dorsal arista and the fore tarsi are simple, with the second to fifth joints slightly broadened.

Types from the San Juan Mts. near San Blas, Province of Santa Clara, Cuba, February 1927.

The female is very much smaller than the male, but this undoubtedly represents only individual variation as there are no morphological differences aside from the secondary sexual characters of the antennæ and front tarsi.

As indicated in the preceding key, this species is distinguishable from the three known South American species by the presence of a series of three large bristles on the anterior tibia; from *C. anacleti* and *C. epicantha* by its dark color, and from *C. fusca* and *C. epicantha* by the appendage of the first tarsal joint of the front leg. This peculiar structure is present in *C. anacleti.*

SOME CUBAN PHORIDÆ WHICH VISIT THE FLOWERS OF *ARISTOLOCHIA ELEGANS.*

By Charles T. Brues.

During a stay at the Harvard Biological Station at Soledad, Cuba some time ago, Mr. Robert M. Grey, the Curator of the Botanical Garden showed me a beautiful group of Aristolochia vines which are grown in one corner of the garden near his house. He told me that they were regularly visited by small Diptera which he thought were Phoridæ and since I have been interested in the members of this family for many years we searched in the few flowers present at that time in hopes of finding some flies. None were to be found, but Mr. Grey promised to send me some at the season when the Aristolochias bloom in greater profusion. He did not forget his promise and I received recently a series of specimens which include two common species of West Indian Phoridæ. These are *Dohrniphora venusta* Loew and *Aphiochæta scalaris* Loew, both present in apparently about equal numbers.

It is of course well known that various small insects, particularly Diptera, enter the flowers of Aristolochia through the corolla tube which in some species is lined with reflexed hairs that prevent the escape of the visitors until the withering of stigmas and the opening of the anthers. Then the barricade of hairs withers likewise and the insects escape. As the flowers are protogynous, cross fertilization is affected by the first entrance of the insects if they come from another flower, and they later leave with pollen acquired toward the end of their imprisonment.

Several observers have recorded the insect visitors of a number of species of Aristolochia (Spengel, Hildebrand, Delpino, Correns, Carr[1]) and find that most of the insects are small Diptera of various kinds. Verrall (British Flies, vol. 1, p. 47) noted in England that *Aristolochia clematitis* is visited most commonly by gall midges (Itonididæ), although Müller and Delpino found

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[1] References to many earlier publications are contained in Knuth's well known Blütenbiologie vol. 2, pt 2, pp. 366-372; Carr's account is in the Entomologist's Monthly Magazine, vol. 60 (1924) p. 258).

Ceratopogonidæ, Chironomidæ, Scatopsidæ and Oscinidæ in the flowers. These families are represented in the flowers of other species of Aristolochia quite generally and in several species Phoridæ have been found. The specific names of the Phorids are unfortunately not reliable in any of these old accounts.

Carr found, however, in *Aristolochia sipho* a Phorid, *Aphiochæta dahli* Becker commonly present together with several other small flies of other families. All the flies sent by Mr. Grey from the Cuban flowers of *Aristolochia elegans* are Phoridæ, as indicated above.

A NEW SPECIES OF THAUMATOMYRMEX FROM CUBA.[1]

By Wm. S. Creighton.

The genus *Thaumatomyrmex* has hitherto been known from two species, *T. mutilatus* Mayr and *T. ferox* Mann. *T. mutilatus*, the type of the genus, was first described by Mayr in 1877 from material collected in Santa Catharina, Brazil. Unfortunately there are no field notes accompanying the description, even the collectors name having been omitted. Although Mayr was the first to describe this bizarre genus it seems altogether likely that the credit for its original discovery should go to Von Ihering. This worker began his observations and collecting in Rio Grande do Sul in 1880, seven years prior to Mayr's description. Von Ihering's publication appeared in 1894 and in it Emery, who prepared the taxonomic section, figured for the first time the head of *T. mutilatus*. I have been unable to find any references to this ant, in Von Ihering's rather voluminous field notes which form the major part of the paper. In 1920 Dr. W. M. Mann while collecting in Honduras, took two workers of a second species, which he described two years later as *T. ferox*. These specimens were found "in a depression in a half rotten log near a stream in the forest" (San Juan Pueblo).

The discovery of a third species in Cuba is of interest since it definitely places the genus with a number of genera known to be indigenous to the Antilles and to the tropical portions of the continent as well. The importance of a rare ant such as *Thaumatomyrmex* in the study of distribution will be obvious to anyone who has been confronted by the ever increasing problem of "tramp" species. Additional interest lies in the circumstances under which the new species was secured. These, while by no means conclusive, at least offer a hint as to the habits of the ants of this genus. In the fall of 1927 the writer enjoyed the privilege of spending two months at the Harvard Tropical Research

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[1] Contribution from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 296.

Laboratory at Soledad, Cuba. Toward the end of that period a trip was made to the Mina Carlota, a pyrites mine in the Sierras to the south of Cumanyagua. The country in the vicinity of the mine is characteristic of the Cuban mountains; heavily wooded and excessively steep slopes with numerous limestone outcrops. The shells of land snails, always in evidence wherever the limestone occurs, were present in the greatest abundance, there being certain areas in which the ground was literally carpeted with the empty shells. Mr. W. J. Clench, Curator of Conchology of the Museum of Comparative Zoology, made a large collection of these, and on the return of the party to Soledad the new *Thaumatomyrmex* was discovered among the shells which had been spread out for sorting. Only one specimen was found and since the time was too short to permit a return to the Mina Carlota, no search could be made for other specimens. It may be that the occurrence of the ant in the snail shells was entirely fortuitous and yet it does not seem unlikely that the extraordinary mandibles are in some way connected with a diet of snails. At least there is an analogy in the pronounced, though less striking, modification of the mandibles of certain snail-eating beetles of the genus *Cychrus*.

Thaumatomyrmex cochlearis sp. nov.

Worker. Length: 4 mm.

Head subquadrate, plainly longer than broad, the occiput very feebly impressed in the middle; the sides behind the eyes somewhat converging toward the occiput; the two prolongations of the genæ anterior to the eyes strongly divergent, the maximum width of the head occurring at the insertion of the mandibles. The eyes large and convex, composed of about fifty very distinct, coarse facets. Antennal lobes prominent, ending in front in distinct angles. Antennal scapes stout, increasing in thickness throughout their anterior half, their tips just reaching the occipital border. First funicular joint slightly longer than the succeeding two together; joints 2-7 distinctly transverse, the following three increasing in length; the terminal joint approximately as long as the four preceeding joints together.

Mandibles composed of a short basal portion from which project three long spines. Outermost spine evenly curved and tapering towards its tip which just reaches the opposite side of the head when the mandibles are retracted Median spine less curved and about two thirds as long as the outermost. Innermost spine straight, one third as long as the outermost. Clypeus slightly concave. Prothorax, seen from above, with strongly convex sides, considerably broader than the remainder of the thorax and separated from it by an impressed suture; in profile subquadrate, slightly convex above. Mesonotum greatly reduced, barely one tenth as long as the pronotum. Epinotum about one and one half times as long as the pronotum, its basal face, in profile, feebly convex, much longer than the declivious face from which it is separated by a well marked angle. Petiole, seen from above, trapezoidal, widest behind, slightly wider than the epinotum; in profile slightly higher than the epinotum, the summit convex, passing by a curve to the somewhat slanting anterior face and more abruptly to the almost perpendicular

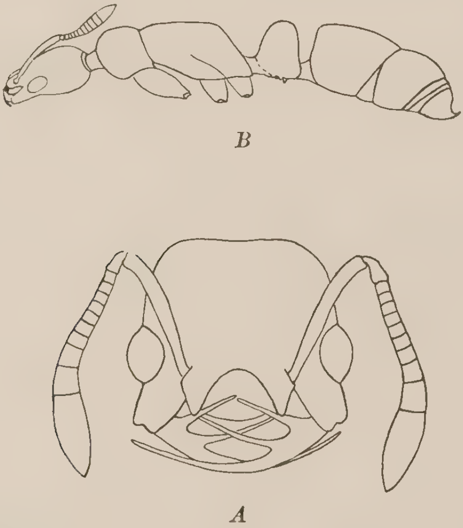

Fig. 1. *Thaumatomyrmex cochlearis* sp. nov. worker. *A*, dorsal view of head; *B*, profile view.

posterior face. The lower surface with a serrate lamina which ends posteriorly in a blunt tooth. Gaster large with a flat, perpendicular anterior face; constriction not pronounced; sting short and stout.

Head with numerous fairly coarse punctures interspersed with delicate striæ which together with the punctures give it a submatte appearance. Clypeus and dorsal portions of the forward-projecting lobes more plainly striate, without punctures. Thorax more shining, punctures somewhat sparser, the striæ confined to the sides of the epinotum. Punctuation of the petiole as in the thorax, without striæ. Abdomen much more shining, the punctures noticeably sparser.

Hairs long, brownish yellow. Sparse on the head, somewhat more numerous on the thorax and petiole, abundant on the gaster. Those on the appendages short, fine and appressed.

Piceous black; mandibles, antennæ, frontal lobes, legs and the tip of the gaster brownish yellow.

Mina Carlota, Cuba. December 2, 1927.

Through the courtesy of Dr. W. M. Wheeler I have been able to compare the new species with a cotype of *T. ferox* Mann. Mayr's description together with Emery's figures allow a fairly satisfactory comparison with *T. mutilatus*. The new species appears to be intermediate in structure between the two, although sufficiently distinct from either to amply justify its specific status. The head of *T. cochlearis* is plainly longer than in *ferox* but shows a similar dilation anterior to the eyes, a condition which is not present in *mutilatus*. The occipital angles are distinctly more acute in the new species giving the head a more quadrate appearance than in either of the previously described forms. The mandibles of *cochlearis* are similar to those of *ferox* but the terminal spine is shorter and the median spine feebly arcuate rather than sinuate. Both *cochlearis* and *ferox* may be separated from *mutilatus* by the absence of the rudimentary fourth spine at the base of the third. *Cochlearis* further differs from *ferox* in the longer basal face of the epinotum, the shorter mesonotum the noticeably narrower petiole and the very different sculpture. In this last it appears to approach *mutilatus* in which the sculpture is even more pronounced.

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1911 Genera Insectorum, Plate 2, Fig. 5, 5b.

SOME CORDIA AND TRIPLARIS INSECTS.

Owing to unavoidable delay in the preparation of a comprehensive paper on the myrmecophytes of the Neotropical Region and their insect tenants, it has seemed advisable to publish at this time three short papers kindly contributed by Mr. H. S. Barber, Dr. W. M. Mann and Prof. T. D. A. Cockerell on some of the undescribed forms belonging to the complicated biocœnoses which center about the peculiar ant-trees, *Cordia alliodora* Ruiz and Pavon and *Triplaris americana* L.

W. M. Wheeler.

I. A NEW BOLIVIAN SILVANID BEETLE FROM THE MYRMECODOMATIA OF CORDIA.

By H. S. Barber,

Bureau of Entomology, Washington, D. C.

Since Dr. Wheeler (Zoologica Vol. 3 pp. 35-134) described the remarkable biological relationships between *Coccidotrophus socialis* Schwarz and Barber and mealy-bugs of the genus Pseudococcus in the myrmecodomatia of *Tachigalia paniculata* Aubl., Dr. W. M. Mann has discovered a second species of Coccidotrophus in Bolivia, in the hollow swellings at the forking of the twigs of a different ant-sheltering tree, *Cordia alliodora* Ruiz and Pavon. The beetle must have been living under adverse conditions, since it was encountered only once among a great many of the hollow swellings which were opened, but according to Dr. Mann, it was attending Coccids as described by Wheeler for the species from British Guiana.

Coccidotrophus cordiæ sp. nov.

Similar to *C. socialis* but larger and more robust: head, pronotum and elytra relatively much broader; antennal club broader.

Length 4.3-4.9 mm., width 0.8-0.9 mm. Habitat, Bolivia.

Head transverse; front feebly convex, shining, densely, finely, shallowly punctulate, the punctures becoming microscopically ocellated and more densely placed posteriorly and laterally. Pronotum seven-eighths as wide as long, widest at the prominent anterior angles, five-sixths as wide at base, surface transversely convex, finely punctate, median line impunctate. Scutellum large, twice as wide as long, one-fifth as wide as elytra, surface shining with transverse postmedian elevated line and posterior marginal stria. Elytra as wide as pronotum at anterior angles, three times as long as wide, shining,punctate-striate, intervals impunctate, apices separately rounded. Male with last sternite longitudinally broadly concave and strongly tumid at sides near apex, hind femora armed with tooth at middle of upper carina of inner edge: female with depressed and elevated areas of last sternite more feeble.

Type, allotype, and one paratype No. 26488, U. S. N. M.

Described from a male and two females collected with scale insects in hollow swellings at fork of twigs of *Cordia alliodora* Ruiz and Pavon (probably var. *boliviana* Chodat and Vischer) near Huachi, on the Rio Beni, approximately latitude 15°40′ south longitude 67°20′ west.

II. A NEW MICRODON FROM PANAMA.

By Wm. M. Mann,

National Zoological Park, Washington, D. C.

Dr. Wheeler has recently given me two pairs of an interesting *Microdon* from Panama. The species is apparently new and a description follows.

Microdon wheeleri, new species.

Female. Length 8 mm.

Form rather long and slender. Color testaceous, with the ocellar tubercle, pronotum, sides of vertex, metanotum and tip of abdomen strongly infuscated. Shining, coarsely and abundantly punctate. Everywhere with long golden-yellow semirecumbent pile, which at the anterior border of head is thicker and forms a brush.

Frons about twice as long as broad, broadest a little below antennal insertions, sides slightly convergent anteriorly, anterior border broadly concave. Vertex separated from frons by a very feeble transverse impression, strongly convex, at middle with a large, elongate tubercle bluntly projecting in front, bearing the ocelli. Eyes hairless. First antennal joint slender, as long as second and third together, second joint subcampanulate and about half as long as the third which is suboval and broadly rounded at apex; arista two-thirds as long as third joint. Antennal insertions enclosed by a circular elevated carina, which above projects horizontally and is angulately produced at middle. Scutellum broadly rounded at apex, excised at sides and bispinose, the anterior spine slender and acute, the posterior broad and truncate at tip. First abdominal segment twice as broad as the thorax, remainder of abdomen elongate and strongly narrowed apically. Posterior tibiæ at apex and the tarsi strongly incrassate, with a heavy brush of coarse, black setæ on outer border. Wings yellow, clouded apically, veins brown. Halteres yellow.

Male. Black, with black pilosity, except the terminal joint of antennæ, the frons, apical half of abdomen, front and middle tibiæ and all the tarsi, which are reddish brown, with yellow hairs.

Transverse impression between frons and vertex strongly impressed. Anterior border of frons narrowly and more deeply excised than in the female. Scutellum at sides with subequal spines on either side of the convexity.

Pupal case. Length 6.5-7 mm., width 2.75-3 mm.

Yellowish, transparent, not reticulate. Subcylindrical. Anterior spiracles slender, slightly arcuate, about as long as their distance apart at base, black in color, with coarse, unequal, fossulate punctures and, on apical third, several circular impressions. Posterior spiracle rugulose basally and rather strongly carinate.

Red Tank, Canal Zone, Panama. March 28, 1923.

Type and allotype—Cat. No. 26478, U. S. N. M.

Described from two females and two males, reared by Dr. Wheeler from pupæ collected in nests of *Crematogaster* (*Orthocrema*) *brevispinosa* Mayr. subsp. *tumulifera* Forel in *Cordia alliodora* Ruiz and Pavon.

The long and slender puparia, without reticulations and with their heavily fossulate anterior spiracles are very different from any other Microdon pupæ I have seen.

The adults are remarkable for their slender form, elongate front, the large ocellar tubercle and the laterally excised scutellum. The pile is unusually coarse, especially at the front of head and on the thorax, and is mostly a rich golden yellow. The coloration, as described for the female, may not be fully mature. Dr. Wheeler tells me that all the specimens were yellow at the time of emergence and darkened gradually.

III. BEES COLLECTED BY DR. W. M. WHEELER AT FLOWERS OF TRIPLARIS.

By T. D. A. Cockerell.

University of Colorado, Boulder, Colo.

The bees collected by Dr. Wheeler at *Triplaris americana* flowers in the Panama Canal Zone include seven species, which may be readily separated as follows:

Eyes hairy; three submarginal cells. 1

Eyes not hairy, two submarginal cells, or the second evanescent. 2

1. Abdomen mainly dark (Fort Clayton, Feb. 28, two workers at *Triplaris*). *Apis mellifera* Linnæus.

Abdomen with basal portion fulvous (Balboa, March 27, one worker at *Triplaris*). . *Apis mellifera* var. *ligustica* Spinola,

2. Two submarginal cells, bounded by strong dark veins; anterior tarsi (male) with a hollowed boat-shaped structure (♀ would have ventral scopa)......................... *Megachile poculifera* Cockerell

Second submarginal cell bordered by pale or evanescent veins; no such modification of anterior tarsi...............3.

3. Comparatively large robust bees; abdomen banded with orange; head black...............................4.

Small bees; abdomen not banded with orange or head red. 5.

4. First abdominal segment with a continuous orange band... *Melipona fulvipes triplaridis* Cockerell.

First abdominal segment with two orange spots.............. *Melipona orbignyi phenax* Cockerell.

5. Head red, mainly black on vertex; scutellum red.......... *Trigona pectoralis panamensis* Cockerell.

Head black...6.

6. Clypeus with two reddish bars on disc; scape largely dark; larger species. (Three workers at *Triplaris*, Balboa, March 26)...............*Trigona cupira* F. Smith...

Clypeus without reddish bars on disc; scape red; smaller species (Eight workers at *Triplaris*, Balboa, March 26)... *Nannotrigona testaceicornis* (Lepeletier)

Melipona fulvipes triplaridis Cockerell, 1925.

Worker. A little larger than usual, with the orange abdominal bands broader. Triangular supraclypeal mark, line down middle of clypeus, stripe at each lower corner of clypeus and narrow band along orbits extending about half-way up front, all cream-color; scutellum entirely black except a yellow transverse line at apex; wings longer and more dusky; femora and tibiæ black; middle basitarsi black, and hind ones except apical corner; apex of abdomen with much white hair. Two workers; at *Triplaris*, Balboa, March 26-27.

A distinct race of the wide-spread *M. fulvipes* Guérin, common in Central America and the West Indies.

Melipona orbignyi phenax Cockerell.

Found by A. H. Jennings at Las Cascadas, C. Z. Dr. Wheeler obtained three males and four workers at *Triplaris*, Balboa, March 26-27. He also took seven workers at Ancon; five are labelled "on Cordia." The worker has a dark clypeus as in typical *orbignyi*. Typical *M. orbignyi* Guérin comes from the southern parts of tropical South America.

Trigona pectoralis Dalla Torre, race **panamensis** Cockerell.

Four workers at *Triplaris*; Balboa, March 26-27. The specimens belong to the race or subspecies *panamensis*, having the hind tibiæ fringed with dark hair. The U. S. National Museum has typical *T. pectoralis* from Mexico, D. F.

Megachile poculifera Cockerell.

Two males at *Triplaris*, Balboa, March 27. A characteristic feature of this species is the tooth on under side of middle femur in the male. In the Brazilian *M. curvipes* F. Smith, it is the hind femur that carries the tooth.

M. poculifera is evidently widely distributed; four males are before me, collected at Guaymas, Mexico in April (E. P. Van Duzee). The original type was labelled Mexico (Baker 1785). Baker's note-book appears to have been lost, but it is fortunately known (see original description of *Prosopis crenulata* Ckll., 1905) that 1785 signifies that it was collected by H. H. Hyde at Medellin, State of Vera Cruz, Mexico.

The Triplaris referred to above is *T. americana*, and the Cordia is *C. alliodora*.

BEES COLLECTED BY NATHAN BANKS IN THE VICINITY OF THE PANAMA CANAL.

By T. D. A. Cockerell.

About one-half of the species collected are as follows:

Melipona orbignyi phenax (Cockerell)

Bella Vista, Aug. 7. I now conclude that *M. orbignyi jenningsi* Ckll. was described from the male of *M. phenax*, the latter (from Ecuador) having priority of place.

Melipona fulvipes triplaridis Cockerell

Barro Colorado, Aug. 2. Larger and more robust than the type of *triplaridis*, but otherwise the same.

Euglossa piliventris imperialis Cockerell

Barro Colorado, Aug. 15. Male

Euglossa cordata (Linnæus)

Barro Colorado, June 20, July 25, Aug. 2

Centris pœcila Lepeletier

Red Tank, June 30. Male. Gribodo (1893) described the male of *C. pœcila* from Panama.

Centris tarsata Smith

Barro Colorado, July 24. Female. Agrees with one from Guatemala. Friese considers it a form of *C. lanipes* (Fabricius).

Centris inermis Friese

Red Tank, June 30. Female.

Exomalopsis zexmeniæ Cockerell

Mt. Hope, July 8. Female *E. paitensis* Ckll., 1926, from Peru, is perhaps too closely allied to *E. zexmeniæ* and is probably to be considered only a southern race. Northward (Pt. Isabel, Texas) *E. zexmaniæ* has dark hair behind ocelli, but the Panama form has it very pale reddish. In *E. paitensis* this hair is creamy white.

Melissodes tepaneca panamensis subsp. n.

Female (type). Size and appearance of *M. tepaneca* Cresson, but thorax above with very bright fox-red hair, the disc of mesothorax with a large patch of short black hair, not reaching sides. Head very broad; eyes grey or green (doubtless green in life); clypeus densely rugosopunctate; face and cheeks with dull white hair; some long black hairs behind ocelli, and back of this, the occiput has bright fulvous hair; flagellum bright ferruginous beneath except at base; tegulæ clear ferruginous; wings dusky; lower part of pleura in front with sooty hair; legs with fulvous hair, black on anterior basitarsi in front; scopa of hind legs large; bright ferruginous hair on inner side of hind tarsi; abdomen with dense fulvous bands, second segment with bands at base and middle; fourth with black hair at extreme base, and a little in middle apically; fifth with all hair black except at extreme sides, sixth with black. There is black hair on outer side of middle tibiæ apically, and around hind knee-plate. Male. The single male with the same data, might well pass as *M. tepaneca.* Clypeus lemon yellow; labrum and base of mandibles cream-color; antennæ very long, flagellum bright ferruginous beneath; hair of thorax above fulvous, without any black patch.

Cristobal, Aug. 10 3 ♀. 1 ♂. I thought at first to refer this to *M. tepaneca aschenborniana* Ckll., based on the male from Guatemala, but the fifth segment has black hair in middle, and the hair between the basal and median bands on second segment is dusky yellowish, not black. It also differs from *M. costaricensis* (*Tetralonia costaricensis* Friese). I am not sure that this may not be *Melissodes cajennensis* (Lepeletier) based on the male from Cayenne, but in the absence of females from that region it is impossible to reach any conclusion.

Hypanthidium taboganum Cockerell

Ancon, Aug. 6, male. Bella Vista, Aug. 7. Female. Mr. H. F. Schwarz (American Museum Novitates, 253) has recently treated this as a variety or race of *H. mexicanum* (Cresson). This cannot be correct as I possess a male paratype of *H. mexicanum* and find it to differ radically in the sculpture of the first two abdominal segments, which have stronger, sparse or well separated punctures.

Dianthidium banksi sp. n.

Female. Length 5 mm. (abdomen curved downward); narrow, head and thorax very coarsely punctured; markings of head, thorax and abdomen red, probably yellow in life; red marks of head confined to band along inner orbits, from level of middle of clypeus to more than half way up front, and an entire occipital band not going much below tops of eyes; scape red in front third antennal joint yellow on outer side, flagellum red beneath; tubercles with a small spot; anterior margin of mesothorax with a very broadly interrupted red band; scutellum and axillæ red; tegulæ black; wings very dark; anterior legs yellowish ferruginous in front; middle knees and tibiæ in middle reddish; hind legs black; abdomen finely punctured; first segment with a large red spot on each side, second with a short transverse stripe on each side, third to fifth with entire bands; ventral scopa white. The sides of metathorax are smooth and polished.

Barro Colorado, June 20. Resembles *D. quadrimaculatum* Ckll. (Bolivia) in most respects, differing conspicuously by the black tegulæ and mainly black scape. Resembles *D. gualanense* Ckll. (Guatemala) by the black tegulæ, but differs by the light scutellum and axillæ. The three species are very closely allied.

Ceratina reducta sp. n.

Female. Length about 5 mm.; head and thorax highly polished, smooth, dark olive green; abdomen very faintly greenish, hind margins of segments 3 to 5 obscurely reddish; legs ferruginous, femora dusky, with a more or less evident pale stripe in front. Head round seen from in front; mandibles red in middle; labrum pale red, binodose; clypeus with a very broad ivory-colored band, broadly rounded above, somewhat constricted in middle; short pale stripes at sides of front betewen antennæ and eyes; large pale yellow bands on cheeks, broad above, attenuate below; cheeks almost wholly impunctate; scape light in front, flagellum obscurely reddish beneath; disc of mesothorax impunctate; tubercles pale yellow; tegulæ light ferruginous; wings dusky hyaline, nervures and stigma dark; abdomen beneath with thin pure white hair.

Taboga Island, June 29. Related to such species as *C. quinquemaculata* Ckll. (Guatemala), but on account of the small size, color, and reduced markings, at first suggesting alliance with the smaller members of the *C. dupla* group.

Ceratina viridula Smith

Taboga Island, June 29.

Colletes rohweri Cockerell.

Las Sabanas, July 7, female. *C. rohweri* was described from a male collected at Zaruma, Ecuador. The present female agrees well except in the usual sexual characters, and the lack of distinct bands on the abdomen, but these appear to have been denuded, the specimen being old, with ragged wings. The abdomen is of the fusiform type; the very broad hind tibiæ are covered with black hair on outer side; the thorax above shows much black hair, but there is a dense band of white hair between mesothorax and scutellum; tegulæ very dark brown; wings strongly stained with brown; flagellum obscure reddish beneath except at base; malar space very short; mandibles red apically. In Swenk's table (1908) it stands near *C. intermixtus* Swenk, but is quite distinct. It is somewhat allied to *C. motaguensis* Ckll. (Guatemala).

Halictus townsendi Cockerell

Gamboa, July 9, two males; Ancon, Aug. 4, two females; Cristobal Aug. 10, two females; Red Tank June 30, July 1, two females. The females vary greatly in the size of the head. This is hardly more than a race of the North American *H. armaticeps* Cresson.

Subgenus CHLORALICTUS Robertson

The small bees referable to this group are not readily differentiated without the aid of the microscope. In the following key the characters are mostly microscopic.

Tegulæ closely punctured; front densely punctured; malar region with two little tubercles; flagellum light brown beneath except at base; antennal joints 3 to 5 all short, transverse, much shorter than those following; mesothorax coarsely microscopically tessellate, with rather close fine punctures; area of metathorax with strong but irregular rugæ, going from base to apex; scutellum and posterior face of metathorax roughened; hind spur with four long oblique teeth; first abdominal segment smooth and polished, with microscopic transverse lineolation, the base hairy; basal corners of second and third segments, and fourth very broadly right across, with minute appressed plumose hairs. . . . . *Halictus gœthalsi* sp. n.

Tegulæ not punctured; hind spur with few strong spines. 1

1. Area of metathorax large, not sharply defined, microscopically reticulate, with short plicæ at base only; front very densely punctured; antennal joints 3 to 5 short, the following increasingly longer, but 6 not greatly longer than 5; mesothorax microscopically tessellate and rather closely punctured; scutellum rather sparsely punctured; hind spur with three large spines or teeth. . . . . *Halictus lesseppsi* sp. n.

Area of metathorax with strong rugæ from base to apex; scutellum in middle with a broad band of small crowded punctures, and on each side of this a sparsely punctured area. 2

2. Larger and more robust; mesothorax dullish and coarsely punctured, the surface microscopically tessellate, the punctures closer posteriorly, on posterior middle of disc they are separated on the average by less than a puncture width; antennal joints 3 to 5 not very short, 6 not much longer than 5; hind margin of third abdominal segment very narrowly testaceous. . . . . . . *Halictus gorgasi* sp. n.

Smaller, with mesothorax shining, not coarsely punctured, the punctures sparse on disc; front densely punctured; antennal joints 3 to 5 successively longer; base of second and third abdominal segments with thin bands of appressed plumose hairs, broad at sides, on 2 rapidly narrowing, reduced to a few isolated hairs in middle, on 3 narrow (about 3 hairs deep) in middle. . . . . *Halictus balboæ* sp. n.

To my surprise all these small *Chloralictus* prove new.

Haclitus goethalsi sp. n.

Female. Length 4 mm. or rather more, anterior wing 3 mm.; head and thorax dark green, dull, the clypeus shining; head longer than broad, face rather narrow, clypeus produced; mandibles reddened apically; flagellum obscure reddish brown beneath except basally; mesothorax finely punctured, median groove very distinct; area of methathorax entirely dull, plicatulate; posterior face small; tegulæ very dark; wings greyish, stigma dilute brown; legs dark; abdomen black, shining, white-pruinose at basal corners of first three segments and all over fourth; hind margins of segments obscurely brown.

Bella Vista, Aug. 7, 1924. Compared with H. *pseudotegularis* Ckll., it is larger, and the head is not so round seen from in front. In the Sandhouse table it runs nearest to *H. ellisiæ* Sandh. from Massachusetts, but is of course different. Miss Sandhouse in her description says the wings of *H. ellisiæ* are clear hyaline, but in the table places it with those having more or less dusky wings.

Haclitus lesseppsi sp. n.

Female. Length about 5.5 mm., anterior wing about 3.5 mm.; robust; head and thorax brassy green, moderately shining; abdomen black; mandibles red, bright in middle, extreme base black, tip dark; flagellum ferruginous beneath except at base; tegulæ polished, dark reddish-brown; wings strongly dusky, stigma very dark brown; legs black, with the tarsi bright ferruginous; head broader than long, clypeus little produced; clypeus well punctured, and with coppery tints; supraclypeal area polished, brassy; a shining space above and laterad of each antenna but greater part of front dull, dark green; cheeks broadly rounded, shining with thin white hair; mesothorax moderately shining with coppery tints in middle, punctures distinct under lens, parapsidal grooves distinct; scutellum and area of metathorax shining, postscutellum dull and dark; hair of thorax above dull white, inconspicuous; abdomen shining, very thinly hairy, but quite without hair bands or patches.

Bella Vista, Aug. 7, 1924. Several species are more or less similar to this ,as follows:

H. exiguiformis Ellis agrees in area of metathorax with basal plicæ, and is really a very similar species, but it does not have the clear red tarsi. *H. tropicior* Ellis has the red hind tarsi, but disc of mesothorax is posteriorly sparsely punctured, and not tesselate, but smooth and polished. *H. lesseppsi* has it tesselate all over. *H. chrysonotus* Ellis also has red tarsi, but the area of metathorax is unlike that of any of the Panama species; the mesothorax is much more shiny than in *H. lesseppsi.* The tegulæ are quite a different color from those of *H. balboæ. H. tenax* Sandh. (Colorado) has a similar metathoracic area, but is otherwise different. *H. umbripennis* Ellis (Guatemala) has a red stigma and is quite distinct. *H. deceptor* Ellis (Guatemala) has plicæ of metathoracic area weak and only going one third of way toward margin, but is otherwise quite different. *H. indistinctus* Crawf falls near here by area of metathorax, but legs are all dark. *H. exiguus* Smith differs by the much longer head, smoother and more polished mesothorax, and pale stigma.

Halictus gorgasi sp. n.

Female. Length about 6 mm.; wings short, anterior wing about 3.6 mm.; head and thorax dull brassy green, with very little hair; head broad, clypeus not much produced; apical half of mandibles dark red; clypeus short; clypeus and sides of face with very strong punctures; front dull, very densely punctured, the punctures tending to run into striæ; apical part of flagellum dull red beneath; mesothorax dull, very strongly and coarsely punctured, with slight coppery tints; scutellum more finely punctured, and shining on each side of middle; area of metathorax coarsely wrinkled; posterior face of metathorax dullish, coarsely sculptured, more or less striate, its lateral margins sharply defined; tegulæ very dark brown; wings stained with reddish; and nervures pale dull reddish-brown, the stigma decidedly of the pale type; mesopleura dull and very rough; legs black, with white hair; abdomen black, with very little hair (no bands or spots), extreme apex dark reddish, hind margins of segments obscurely reddish.

Bella Vista, Aug. 7, 1924. Distinct by the coarse sculpture. In the Sandhouse table (1924) it runs to 67, but after that does not fit in well. It could however be compared with *H. crassiceps* Ellis, *H. perpunctatus* Ellis or *H. cattellæ* Ellis, which are species of temperate North America, differing in various respects.

Halictus balboæ sp. n.

Female. Length about 5 mm., anterior wings 3 mm.; head and thorax very dark green, except that the mesothorax and scutellum are brassy green and shining, the mesothorax more brassy that the scutellum; hair thin and pale; clypeus rather sparsely punctured, apical half black and just above the black a rosy zone; mandibles basally black, apically red; head broad sides of face striate-punctate; flagellum obscure reddish beneath; except at base; mesothorax shining and sparsely punctured; area of metathorax glistening, strongly plicate; posterior truncation small, well defined; tegulæ very dark brown; wings hyaline, slightly dusky (greyish, not at all reddish); stigma and nervures dull pale reddish brown; legs black, with pale hair, small joints of tarsi slightly reddish; abdomen shining black with narrow thin hair-bands at bases of second and third segments; apical part diffusely hairy.

Bella Vista, Aug. 7, 1924, three females. *H. hypochlorus* Ellis is superficially similar, but differs by the narrower, submetallic, abdomen, with hind margins of segments more or less reddish.

H. cubitalis Vachal is large (6.75 mm.) and from the meagre description apparently distinct. It is however nearer to this than to any of the other Panama species.

Megalopta fornix panamensis Cockerell

Barro Colorado (Dodge).

Augochlora vesta terpsichore (Holmberg)

Red Tank June 31; Bella Vista, Aug. 7; Ancon, Aug. 9. This is identical with the form from Guayaquil, Ecuador, referred to *A. vesta terpsichore,* in Jn. N. Y. Ent. Soc. 1914. pp. 324 and 327. If it is different from Holmberg's bee, there is at present no way to show wherein the difference lies.

Augochlora nigrocyanea Cockerell

Ancon, Aug. 6 one female.

Augochlora quiriguensis Cockerell

Barro Colorado (Dodge). One female. This has the mesothorax black with green margins, to this extent agreeing with the variety *sidæfoliæ* Cockerell. It is intermediate between the typical form and the variety.

Augochlora cordiæfloris Cockerell

Gamboa, July 9. One female. Compared with the type (from Mexico), it differs by the golden green mesothorax, but this appears to be only a variation.

SOME EXPERIMENTS ON THE NERVOUS PHYSIOLOGY OF DRAGON-FLY LARVÆ.

By C. E. Abbott,

Elgin, Illinois.

A number of students of insect physiology have attacked the problem of nervous control. In 1911 Hilton, while making purely morphological studies of certain insects, discovered that the supracœsophageal ganglion consisted largely of sensory elements, whereas the subœsophageal ganglion was rich in motor nerves. But as far as I am aware, the only work of a functional nature that has been done in connection with dragon-fly larvæ is that of Baldus (1924).

During the past summer it was my good fortune to be located in Madison, Wisconsin, where it was possible to obtain and observe many larval specimens of Anax junius and Aeschna umbrosa. I took this opportunity to study the nervous physiology of these insects.

Before considering the experiments, it is necessary to say something about the gross anatomy of the nervous system. Besides the brain and the subœsophageal ganglion, this consists of three thoracic and seven abdominal ganglia. The prothoracic ganglion lies midway between the bases of the first pair of legs. The other thoracic ganglia are very close to each other; both are near the middle pair of legs. The first abdominal ganglion lies in the second segment of the abdomen, and the remaining ganglia lie in the segments following, so that the seventh or terminal ganglion lies in the eighth abdominal division. Each ganglion is connected to the adjoining parts of the body by a pair of lateral nerve fibers. The thoracic ganglia are all large, as also is the terminal abdominal ganglion, but the remaining nerve masses are small. With the exception of the brain, the entire nervous system lies so near the ventral surface of the animal that it is visible through the chitin. The subœsophageal cannot be seen from without. It is located near the base of the labium. The brain is visible through the dorsal surface of the head.

To study the function of various parts of this sytem it is only necessary to destroy various parts of it with a needle or a fine knife. Moreover, the vitality of the larvæ is so great that such an operation does not seriously interfere with the vital processes. In all of the experiments, larvæ four to five centimeters long were used.

The prothoracic ganglion of a larva was crushed with a needle. For half an hour after the operation the insect remained motionless. When once it recovered, it could be induced to crawl by gently stroking the dorsal surface of its abdomen. The first pair of legs, limp and powerless, were not used in the process. In the water the larva moved the mildde and rear legs convulsively and irregularly. The mouth-parts moved when touched. Respiratory movements were normal. There was no response to visual stimuli.

The mesothoracic ganglion of a larva was destroyed. After the passage of the shock period the first and last pairs of legs responded to stimulation. The paralysis of the middle pair of legs made crawling practically impossible. Like the preceding larva, this one did not respond to visual stimulation. It also gave little evidence of volition.

The metathoracic ganglia of two different larvæ were destroyed. Both insects gave evidence of shock, disturbance of equilibirum in the water, lack of volition, and inability or disinclination to respond to visual stimuli. Both made some effort to crawl. The rear legs were completely incapable of action and did not respond to stimuli. In the water the first and second pairs of legs moved convulsively. One insect was fairly active; the other seemed almost dead.

The first abdominal ganglion of a larva was destroyed. Although the respiratory movements were somewhat labored and weak after operation, the animal was otherwise quite normal.

The destruction of the third abdominal ganglion of another larva had even less effect than the preceding; the behavior of the insect differed in no way from that of a normal animal.

Destruction of the fifth abdominal ganglion of another insect resulted in a temporary cessation of respiratory movements.

In the case of a larva with the seventh abdominal or terminal ganglion destroyed the effects were more marked. Not only were the respiratory movements much altered, but the movements of the cloacal spines were completely inhibited.

The last two abdominal ganglia were successively destroyed, and later the entire abdominal part of the nerve cord was removed. Immediately after the destruction of each single ganglion there was a suspension of respiratory action. Later these movements became normal. The removal of all abdominal ganglia led to a complete and permanent cessation of all respiratory movements. There was also a marked decrease in volition, and no responses to visual stimuli.

The subœsophageal ganglion of a larva was destroyed. This inhibited the movements of the mouth-parts; otherwise the insect was normal.

In another case the brain of a larva was cut through in a median plane. The larva tilted its body to the right, and crawled and swam in circles in the same direction. Its reflexes were quite normal.

When the brains of several larvæ were removed through large holes in the heads, and the openings closed with asphaltum, a strong shock effect was produced. After that, responses were normal. The breathing, at first irregular and spasmodic, soon became normal. When resting on a solid surface out of water, the larvæ responded by movements of the abdomen or by crawling. The mouth-parts, and the legs, exclusive of coördinated actions such as crawling, moved spontaneously. Swimming movements were not strong, and probably resulted simply from normal respiratory movements. There was no volition and no response to visual stimuli.

The results of Baldus (1924) with *Aeschna cyanea* seem to have been similar to those just described. Baldus states that he was able to keep larvæ alive for long period with no heads at all. Most of my specimens did not live over forty-eight hours. But my results agree very well with those of Baldus: namely that the brain of the larva, while important, is not as essential to the animal as that of a vertebrate to its possessor. From the above data it is possible to draw the following conclusions:

1. The abdominal ganglia of dragon-fly larvæ control respiratory movements and abdominal movements generally, but this control is so distributed between them that the destruction of one or two does not permanently interfere with respiration.

2. The seventh or terminal abdominal ganglion not only has a greater part of the control of respiratory movements than do the other ganglia, but it also is the seat of the reflex involving the movements of the cloacal spines and probably of the cloacal valve.

3. Each thoracic ganglion controls the actions of the legs attached to its segment. It also has something to do with equilibrium.

4. The subœsophageal ganglion controls the reflexes of the mouth-parts, and without it they cannot act. But the ganglion itself *receives no direct stimuli*, excepting possibly, those that come through the mouth-parts themselves. Its responses are initiated by stimuli which come through the brain or from other parts of the nervous system.

5. The brain is the sensory, directive, and associative center. Without it responses to visual stimuli cannot take place, and all coördinated spontaneous movements are inhibited. It also serves in some way as an organ of balance and orientation. The mouth-parts cannot act selectively without the brain. In short, the *real* brain of the insect consists of both the sub and the supraœsophageal ganglia. The former is the motor, the latter the sensory mechanism.

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A NEW PROTODONATAN FROM THE GRAND CANYON.[1]

By F. M. Carpenter.

Through the kindness of Dr. David White of the United States Geological Survey I have had the opportunity of studying three fossil insects, which he collected about a year ago in the Hermit Shale (Lower Permian) of the Grand Canyon. Two of these specimens are so incompletely preserved that their exact affinities cannot be determined; one appears to be the posterior half of the abdomen of an Odonate insect, and the other, a forewing of a blattid. The third fossil, however, is a nearly complete wing of a Protodonatan, described below as *Typus whitei*, n. sp., and is particularly interesting because of its close relationship with *Typus gilmorei* Carp., also from the Hermit Shale[2]. This latter species, which is based upon a specimen collected by C. W. Gilmore in 1926, is the only fossil insect previously known from the Grand Canyon.

The order Protodonata was originally established by Brongniart in 1884, and later extended by Handlirsch to include a series of Odonate insects, occurring in the Carboniferous and Permian formations of both hemispheres. Although the order has usually been considered to be directly ancestral to the Odonata, the recent researches of R. J. Tillyard have led him to conclude that these two orders are parallel groups, derived from a common stem, the Carboniferous Megasecoptera. The meganeurid genus, *Typus* Sell., includes only the genotype, *T. permianus* Sell., from the Lower Permian of Kansas, in addition to the Grand Canyon species. All three of these species were large in comparison with most living insects, having an expanse of about eight inches, but were small beside the 28 inch *Meganeura monyi* Brongn., from Commentry. The new species is a little smaller than the genotype.

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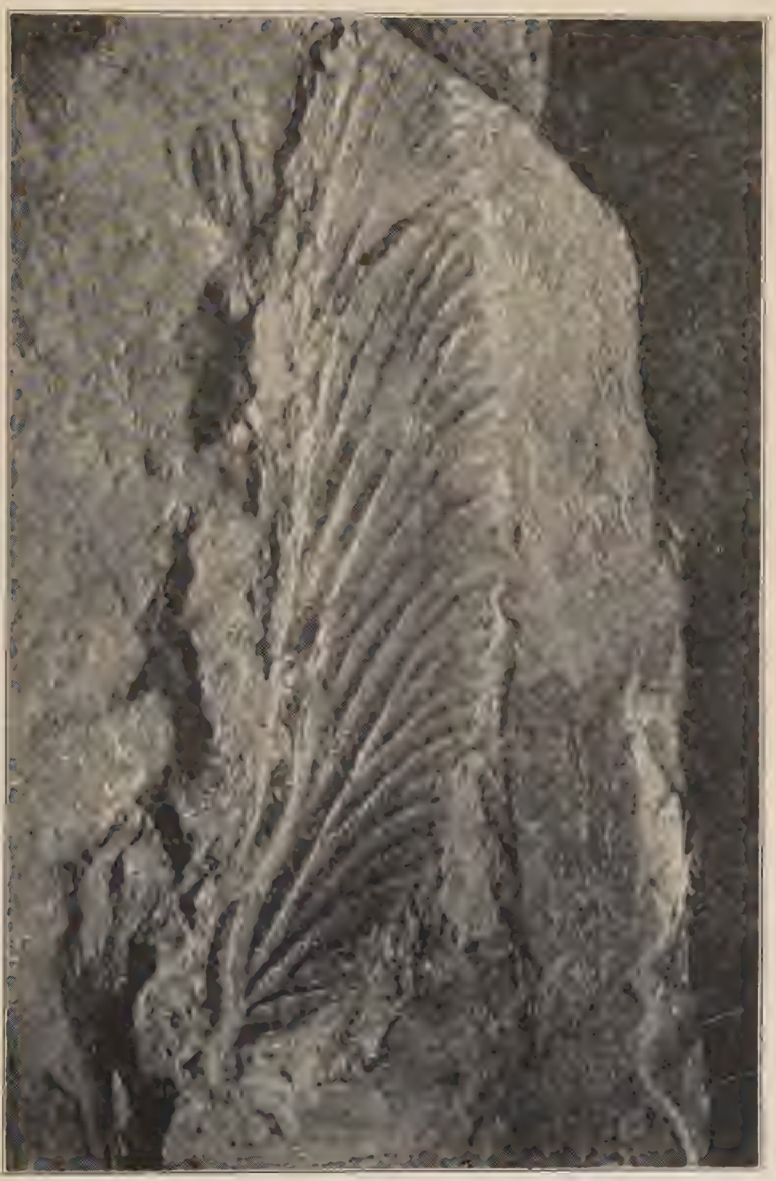
[1] Contribution from the Entomological Laboratory of the Bussey Institution of Harvard University, no. 299.

[2] Carpenter, F. M. Proc. U. S. N. M., 71, art. 23. 1927.

[3] Sellards, E. H. Amer. Journ. Sci., (4) 22: 249-258, 1906.



TYPUS WHITEI CARPENTER

Typus whitei, n. sp.

Described from a nearly complete forewing, with the following characteristics: wing rather broad, with a pointed apex, and reduced anal area; hind margin greatly curved. Length of wing, 9.3 cm.; estimated width, at middle of wing, 2.2 cm. Rs arising close to the base of the wing, not far from the origin of R1; R2 and R3 diverging well beyond the middle of the wing; M+R straight at base, but diverging downwards after the origin of R1; Cu2 and 1A deeply undulated, the curves of these veins corresponding; 2A straight; Cu2 reaching the hind margin of the wing at a point about two-thirds the wing-length from the base. The costal margin has been entirely macerated away, only the apical parts of Sc and R1 remaining. There are a few cross-veins visible between the bases of M+R, Cu2, and 1A.

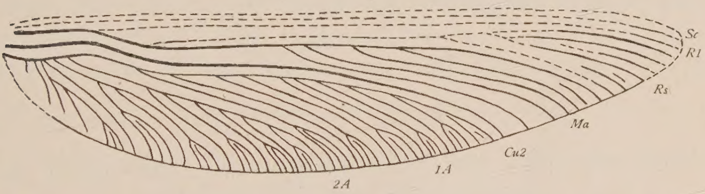


Fig. 1. Venation of *Typus whitei* new species from the Hermit Shale of the Grand Canyon.

Sc, subcosta (concave); R, radius (convex); Rs, radial sector (concave); Ma, anterior media (convex); Cu2, Posterior cubatus (concave); 1A, first anal (convex); 2A, second anal (concave).

Holotype: catalogue number 71713, United States National Museum; collected by Dr. David White on the Bright Angel Trail, Grand Canyon National Park, Arizona, under the auspices of the Carnegie Institution.

Horizon: Lower Permian.

At first glance this wing might be taken for the hindwing of *T. gilmorei* Carp., since it is slightly shorter and broader than the latter. But the reduced anal area is not at all characteristic of a hindwing of the Protodonata, as far as the order is known to us, and the differences in venation can hardly be explained in this manner. The most obvious of these differences is that the undulations of Cu2 and 1A in *T. whitei* exactly correspond, which is not true of *T. gilmorei.*

This new fossil, being much better preserved than the type of *T. gilmorei,* shows very clearly the position of the origin of Rs, which was obscure in the latter specimen. In all probability the origin of Rs in *gilmorei* was similar to that in Dr. White's specimen, and not as suggested in my description of the former.

EXPLANATION OF PLATE 5.

Photograph of holotype of *Typus whitei,* n. sp., from the Hermit Shale of the Grand Canyon. (x 1.5).

SOME CUBAN CICADIDÆ, CERCOPIDÆ AND MEMBRACIDÆ.—A CORRECTION.

BY J. G. MYERS.

In the list of Cuban cicadas (*Psyche* XXXV, p. 120) there is an error due to a misplaced correction in the proofs. The second species should be omitted entirely, the third should be *Odopæa sagræ* (Guér.), while the sixth should read as follows.—

Juanaria pœyi (Guér.) *in* de la Sagra, *Hist. fis. nat. Cuba,* p. 425, 1857; syn. *Juanaria mimica* Distant, *Ann. Mag. Nat. Hist.,* (8) IX, p. 644, 1912. To Mr. Wm. T. Davis is due the credit of discovering this synonymy.

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